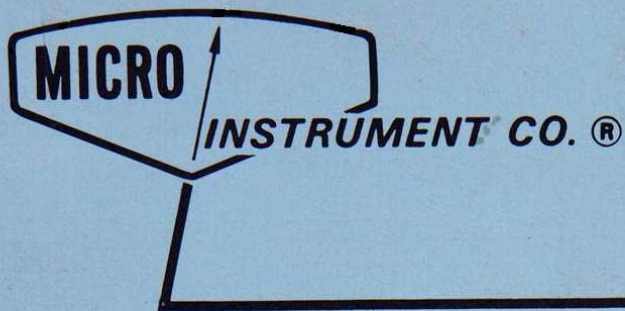




MODEL

5201C

TECHNICAL

MANUAL



MICRO
INSTRUMENT CO. ®

MODEL
5201C

TECHNICAL
MANUAL

LIMITED ONE YEAR

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MODEL 5201C
MEMORY VOLTMETER
TECHNICAL MANUAL
REVISION 1

This manual covers models:

5201C	Portable Cabinet
5201C-1	Single Unit Rack Mtg.
5201C-2	Dual Unit Rack Mtg.
5201CR	Recording Memory Voltmeter

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SECTION 1.0 - INTRODUCTION

1.1 DESCRIPTION - The Model 5201C Memory Voltmeter is a versatile, wide-range voltmeter having amplitude memory. This instrument is capable of measuring voltage ranging from dc to rf, and of recording their maximum amplitude. Continuous or one-shot transient pulses as short as 50 nsec in duration will be recorded. The reading is held in electronic circuitry and read out on a five inch precision meter until reset by the operator. Pulses of greater amplitude than the stored voltage will cause the readout to increase; thus the instrument will display the maximum pulse detected. A MODE switch is provided which allows the instrument to read peak positive, peak negative, or the maximum peak of positive or negative; all of which can be ac or dc coupled.

The Model 5201C is as simple to operate as a conventional voltmeter and is considerably more versatile. The all solid state instrument may be used for unattended monitoring of equipment, test set-ups, and power lines. Transients, drift or other malfunction, will be recorded for the latter evaluation by the operator.

The Model 5201C will retain its reading during momentary power interruptions. This feature, combined with very low power consumption, further increases its value in applications where transients occur at random or where continuous monitoring is required.

In addition to its use as a transient recording instrument, the Model 5201C may be used as a conventional dc voltmeter or ac peak reading voltmeter. To accomplish this, the instrument is provided with an automatic reset circuit that

may be adjusted over a wide range.

Versatility, simplicity, and reliability are features that have been designed into this instrument. All calibration and zero controls located internally are readily accessible. The instrument is constructed with plug-in printed circuit boards, thus permitting simplified maintenance and speedy field repairs or replacement.

Model 5201CR is similar to the Model 5201C, except for a built-in strip chart recorder that utilizes one of the Model 5201C three-recorder outputs for permanently recording on chart paper. This recorder is a dry process, pressure sensitive 63" chart with access window. Chart speed is 30"/hr. standard yielding 25 Hr. continuous recording. Chart speeds from 10"/hr. (3 day) to 150"/hr. available on request.

The Model 5201C (Rev. 1) Memory Voltmeters are provided with a five-position response selector control. This control permits the bandwidth of the instrument to be reduced which may be desired in certain applications. A typical application is where the waveform to be measured is of low frequency and unwanted high frequency noise is present. The response selector control may also be used to obtain a relative measure of the energy contained in transients. In the narrow band positions only transients with high energy content (wide pulse width) will be recorded.

The five response selector positions are labeled 'NORM', '1 us', '10 us', '100 us' and '1 ms'. Each numbered position indicates the approximate 3DB down points for each of the pulse widths indicated. The 'NORM' position has no bandwidth limitations other than the normal specifications of the instrument.

The roll off is approximately 6DB per octave for all other positions.

1.2 SPECIFICATIONS -

Input	- Single-ended BNC ungrounded input. May be operated up to 1000V peak above ground. Case grounded.
Voltage Range	- 0-3, 10, 30, 100, 300, 1000V. To 30kV with optional probes.
Input Impedance	- 10 megohms (1000V Range) to 30K ohms (3V Range) depending on range.
Pulse Width Range	- DC to 50 nsec (single pulse).
Accuracy	- $\pm 3\%$ of full scale, dc to 50 nsec.
Readout	- 5" taut-band, mirror-backed 1% meter.
Reset Modes	- 1) Manual, with front panel switch or remote contact closure. 2) Automatic (50 msec intervals, adjustable up to 5 sec intervals with external capacitor). 3) Recorder (automatic reset adjustable from 50 msec to 5 sec after end of measurement).
Reset Time	- 100usec nominal, with no dead-time or loss of response during reset.
Operating Modes	- 1) Reads peak positive. 2) Reads peak negative. 3) Reads maximum peak of positive or negative.
Memory	- Electronic memory retains readings permanently, until reset by operator or command signal, or until advanced to a higher reading due to a greater amplitude input signal. Readings held during momentary power interruptions.

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|-------------------------|---|
| DC Analog Output | - 0 to 1 V or 3 V positive, $\pm 2\%$, depending on range. Short circuit safe. |
| AC Analog Output | - Simultaneous peak positive and negative outputs. 2 1/2 V nominal, decaying to zero in 100 ms at full scale. |
| Response | - Five selectable positions: NORM (wide band), 1, 10, 100 μ s and 1 ms pulse widths. Response is approximately 3 dB down at these points and limits the response at approximately 6 dB/octave rate. |
| Gate Circuit | - Permits sample-and-hold or synchronized measurements via externally applied gating pulses of approximately 5 to 10 V. |
| Temperature Range | - 0° to 50°C operating. |
| RFI and Noise Rejection | - Internal multistage LC pi line filter provided. |
| Input Power | - 115 V or 230 V AC, $\pm 10\%$, 50 - 400 Hz, 15 VA, or ± 24 V DC, 100 mA maximum, battery operation.

Model 5201CR - 115 V AC, 60 Hz standard. 230 V AC, 50 Hz or ± 24 V DC optionally available. |
| Mechanical | - 5201C - Dual shielded portable cabinet approximately 7" x 8" x 12".

5201C-1, 5201C-2, 5201CR - Dual shielded rack mounting enclosure 7" x 19" x 12". |
| Accessories | - 3 1/2 foot shielded input cable and technical manual provided. |
| Options | - High voltage probes: 3 kV, 10 kV and 30 kV probes supplied with insulated shielded cable frequency compensated for pulse applications. |

1.3 INSTALLATION - Carefully unpack the instrument and inspect for any damage that may have occurred in shipment.

If any damage is found, please notify the shipper or your local Micro Instrument Company representative immediately.

To place the instrument in operation, connect the line cord to a source of 115V single phase power. Care should be taken that the power line used is reasonably free from transients or other voltage spikes generated by ac loads, transformers, etc.

Connect the input cable to the instrument and push on the power switch. The meter may read off-scale when the power is applied; however, this is a normal turn-on occurrence. Any off-scale reading is current-limited and can not damage the meter. Place the RESET switch in the AUTO position and allow a few minutes warm-up time. At this time, the meter should return to zero. Set the meter to zero with the zero control, and set the MODE and RANGE switches to the desired positions. The instrument is now ready to use as a broad-band peak voltmeter, or as a peak recording voltmeter by returning the RESET switch to the center position.

During checkout and evaluation of the instrument, it should be noted that transients may occur where seldom expected. If connected, for example, to a battery to check dc accuracy, the Model 5201C may record a voltage much greater than the battery voltage. This is caused by the inductance of the test leads and "bounce" of the connection being mechanically made. This may be verified by using a high frequency oscilloscope. Once the test leads are firmly connected and the RESET switch depressed, the instrument will read the battery voltage.

CAUTION

The case of this instrument is electrically connected to ground through the three-wire line cord. The instrument should always be used with the case grounded to insure complete operator safety. The low side of the input (cable shield) and the power supply common in the instrument are floating with approximately .001 uF and 44 megohms to ground. Off-ground measurements may be readily made up to 1000V off of ground. The shield of the input cable should always be connected to the lower potential side of the signal being measured. Caution should always be used on all off-ground measurements as the shield of the input cable will assume the same potential as the circuit point to which it is connected.

BATTERY OPERATION

When operating the Model 5201C with external battery supply, be sure that the case of the instrument is still grounded to a good ground point. This is very important when using the instrument in areas having high RF radiated interference. In addition, the lead to the batteries including the common should be shielded to avoid coupling of RF energy into the instrument. This is true of any of the external connections made, such as remote reset, etc.

To operate from batteries, connect a battery (18 to 24V) with its positive terminal to Pin 9 on J2 (rear of instrument) and its negative terminal to Pin 10 (Common). Connect a second battery with its negative terminal to Pin 11 on J2 and its positive terminal to Pin 10 (Common). Both batteries should have capability of supplying approximately 100 mA. See Page 3-5 for detailed operation.

SECTION 2.0 - OPERATING PROCEDURES

2.1 GENERAL - The Model 5201C Memory Voltmeter is used in a similar manner as a conventional voltage measuring instrument. It is also comparable to an oscilloscope having a beam remaining deflected in the vertical axis and corresponding to the peak of the applied waveform. The MODE switch of the Model 5201C allows the meter readout to deflect proportionately to the oscilloscope beam deflection.

For example, if an oscilloscope were set to its dc mode of operation and connected to a 100 vdc power supply, the beam would be deflected vertically in proportion to the 100v input. If a surge or transient occurred in the power supply, causing the output of the supply to increase momentarily to 150v, the oscilloscope beam would deflect proportionately to 150v. The identical action will occur in the Memory Voltmeter, except that the voltage will cause a meter deflection rather than an oscilloscope beam deflection. In addition, the meter deflection will not return to 100 volts after the transient passes, but will remain at the 150 volt point until the RESET switch is depressed, or until an input transient in excess of 150v occurs, causing the meter to read the higher value.

Similarly, as in an oscilloscope, if the MODE switch were set to ac and the instrument were connected to the same power supply, there would be zero deflection after the initial charging of the input capacitor. If the same 50 volt surge occurred as before, the beam would be deflected proportionately to 50 volts on the screen. The Model 5201C Voltmeter will also indicate a reading of 50 volts until reset, or until an input transient in excess of 50 volts occurs.

In summary, the Model 5201C Memory Voltmeter is a broadband, dc to rf, peak-reading voltmeter that retains a continuous reading of the maximum applied peak voltage. In addition, the MODE switch performs the same functions as the MODE switch on a dc to rf oscilloscope.

NOTE: In the ac mode of operation, the input signal is coupled through a dc blocking capacitor located inside the instrument. When a pulsed or ac repetitive waveform is passed through this coupling capacitor, the peak voltage is dependent on the waveform duty cycle. For example, a 100v pulse voltage with a low duty cycle will produce a 100v output pulse. However, the same 100v pulse voltage with a high duty cycle (50%) will produce only a 50v peak output. This must be taken into consideration during calibration and checkout of the instrument. For ac calibration, the duty cycle of a repetitive waveform MUST have a duty cycle of less than 1%.

2.2 HIGH VOLTAGE PROBES - The MICRO INSTRUMENT COMPANY High Voltage Probes are used to extend the range of the Model 5201C Memory Voltmeter up to 30kV. Three probes are available, 3kV, 10kV and 30kV. The probes are identical in appearance with the exception of the multiplier resistors and frequency compensating capacitors used. All probes are fitted with a banana plug tip having a removable insulated alligator clip attached. The probes are furnished with insulated shielded cable and built-in ground lead and a connector that plugs directly into the Model 5201C instrument.

When using either probe, the Model 5201C Controls should be set as follows;

RANGE	- 1000v (300v for 3kv probe)
MODE	- DC+ or DC-

Never use the AC+ or AC- modes, as the internal dc blocking capacitor in the instrument is only rated at 1000v. The dc modes are used for all dc, ac and pulse measurements. The ac modes of the instrument are generally used only where the dc component of the waveform being measured is very large compared to the ac component. Further information is available in other sections of this technical manual.

To use the probes, set the controls as above and connect the ground lead to the chassis of the equipment under test. Hold the probe tip to the point being measured and read the meter after pressing the RESET switch. Multiply the reading on the 3 scale by x 1000 for 3kV probes, or the reading on the 10 scale by x 1000 for 10kV probes, or the reading on the 3 scale by 10,000 for 30kV probes.

The input impedance of the Model 5201C Voltmeter is 30 megohms using the 3kV probe, 100 megohms using the 10kV probe and 300 megohms using the 30kV probe. The maximum shunt capacitance is 10pF on all probes.

CAUTION

High voltages are always dangerous, and it is assumed that the user of these probes is familiar with the necessary safety precautions required to insure maximum operator safety. Always keep the high voltage probes clean and dry. It is a good practice to wipe the body of the probe with a dry cloth before using.

2.3 RESET MODES -

2.3.1 NORMAL MODE - When the RESET switch is in the center position, the instrument will read and hold the maximum applied voltage. This reading will be stored in the memory circuit until reset by momentarily depressing the RESET switch downward. This clears the memory circuits, and the instrument may be used to register other applied voltages. The memory circuits may be reset with an external contact closure or transistor switch from Pin 7 to Common (Pin 5) on the rear terminal strip.

If a transistor is used for remote reset, use a PNP-type.

Connect the collector to Pin 7 (-10 volts at 1 mA) and emitter to Common (Pin 5). A base drive signal of approximately -100uA for 10u sec is required for reset.

2.3.2 AUTOMATIC MODE - When the RESET switch is placed in the UP position, internal reset pulses are automatically generated. These reset pulses have a repetition rate of approximately 50 msec and may be increased up to 5 sec periods using external capacitors (Pin 8 on J2). When the automatic reset pulses are applied to the memory circuit, the register is cleared and a new reading stored if there is an input voltage present. Since the register can store a reading in approximately 200u sec and the input waveform is stretched to approximately 100 msec, no loss of input voltage will occur during the reset period. The instrument thus becomes a peak voltmeter reading the average of the peak value of all input voltages from dc to rf.

2.3.3 RECORDER RESET MODE (AUTOMATIC) - The instrument may be used with recorders, including strip chart recorders having a very low frequency response. This is readily accomplished using the instrument in the Automatic Mode. In this mode, the automatic reset pulse is inhibited for at least several

seconds whenever an input signal is received or increases in value. By adding nonelectrolytic capacitors up to approximately 5 μ F from Pin 8 to Pin 5 on the rear terminal strip (J2), the time between reset pulses may be increased up to 5 sec. Thus the recorder receives a dc output signal lasting several seconds - before reset occurs - whenever the input is applied or exceeds the previously applied voltage. Using the dc recorder output in the recorder mode, strip chart recorders having a frequency response of less than 10 Hz may be used to record nanosecond pulses. The dc recorder output is Pin 2 and Common (Pin 1) on the rear terminal strip. The recorder mode of operation may be inhibited by shorting Pins 5 and 6 on J2 with a shorting link.

When using strip chart recorders having higher frequency response, the ac recorder pulse outputs may be used. Positive and negative stretched pulses are simultaneously available at Pins 3 and 4 on the rear terminal strip and may be used to drive the high frequency strip chart recorders directly. The pulses at these terminals range from dc to 100 msec, depending on the input pulse duration.

For inputs lasting longer than approximately 1 msec, the output will show the input pulse width followed by a 100 msec decay (at full scale). For inputs lasting less than 1 msec, the output will show a 100 msec decay. Thus, an indication of pulse width is available using these recorder outputs and a higher frequency recorder (1 to 5 KHz). The dc component that is present in both the positive and negative may be nulled out using the dc zero controls of the strip chart recorder.

The Model 5201CR instrument has front panel controls that set up the basic 5201C instrument for use with the strip chart recorder. For example when the RECORD switch is placed in the

"up" position, a 5 μ F capacitor is connected to the external timing capacitor terminal thus changing the automatic reset time to approximately 5 sec, and 115 VAC is connected to the chart motor. In this mode, any stored reading or any increase in stored reading will be retained for approximately 5 sec before being reset.

2.4 APPLICATIONS - The Model 5201C Memory Voltmeter is a versatile instrument having hundreds of applications. Several of the more common applications are described in this section of the manual. However, as with any instrument, the use to which it will be put will depend upon the user's requirements.

For more data or additional information pertaining to your particular application, please contact the factory or your local MICRO INSTRUMENT COMPANY representative.

2.4.1 POWER LINE MONITORING - It is often desired to measure transient line voltage excursions, since they may cause damage to equipment supplied from that line. But, because of the random time distribution of most line transients, it is often impossible to capture them with conventional instruments.

The Model 5201 Series Memory Voltmeters (especially with the chart recorder adjunct) are ideally suited for unattended monitoring of power lines. The instruments consume very little power, will hold their readings during momentary power interruptions, and require no steady operator attention. When connected to an AC power line, the instruments will initially display the peak voltage, e.g., 160 V peak for a 117 V rms line. The instrument will retain this reading until a transient occurs exceeding the peak voltage. At that time, the instrument will assume a reading equal to the peak line voltage plus the peak transient voltage. Note, however, that transients that occur when the line voltage is at a low value will not be indicated

unless the combined amplitude of the transient plus the instantaneous line voltage exceeds the peak line voltage. Thus, a 50 volt transient occurring at the zero crossing point of the line voltage waveform will not be recorded.

Simultaneous monitoring of both the positive and negative portions of a power line waveform is accomplished in the " $\pm$ " mode switch position, in which the instrument indicates and records the maximum excursion from zero without regard to polarity.

2.4.2 POWER SUPPLY MONITORING - In the event of catastrophic failure, or merely during turn-on or turn-off periods, power supplies may cause damaging transients to occur. Transients can also be generated during instantaneous overload of the power supply caused by a component failure in the supply load. The series 5201 instruments may be used to continuously monitor any dc supply line. In this application, the instruments serve a dual purpose in monitoring both the steady state dc value of the supply output, and the peak value of any transient excursion above that level.

When monitoring high voltage dc supply lines, it is often convenient to use the instrument in the "AC" mode, wherein the instrument will not register the dc level, but will respond to any excursions above or below that value. This application is especially useful where small transients cannot be tolerated on high voltage dc supply lines. For example, if a 10 volt transient occurred on a 500 volt dc supply line, operation of the instrument on the 10 volt range, in the "AC" mode, would give greater resolution and accuracy in measuring the transient than would operation in the 1000 volt range which would be required to measure the combined steady state and transient voltages.

2.4.3 BREAKDOWN TESTING - The use of these instruments to monitor the breakdown point or firing level of various components is another popular application. An increasing amplitude waveform is applied to the device under test and monitored with the Memory Voltmeter. When breakdown occurs, the instrument will retain the maximum peak value obtained before breakdown occurred.

2.4.4 COMPONENT PULSE TESTING - Because of the reduction of power dissipation in the device being tested, pulse testing techniques are very popularly applied to a wide range of electronic components. The ability of the Model 5201 instruments to accurately measure and record the peak amplitude of a one-shot (or repetitive) pulse as short as 50 nanoseconds makes them ideal for use as readout instruments in pulse testing.

2.4.5 ENVIRONMENTAL TESTING - The Memory Voltmeters find wide application in environmental testing laboratories for monitoring both tests and the results of tests. Used in conjunction with shock, vibration, acceleration, or temperature transducers, the instruments will record peak parameter values achieved during the tests, or, when connected to crucial points in the device under test, the instrument can record possible conditions of failure. The various instrument features such as retention of the maximum peak input voltage, one-shot pulse response, and unattended operation make the Model 5201 series instruments ideally suited to environmental test instrumentation

2.4.6 LIFE TEST EQUIPMENT - Transients occurring in life-test and power-aging equipment may cause failure of the components under test and consequent obscuration of the test data. The Model 5201 series instruments can be used to monitor the voltages applied to the test components, whether ac or dc aging

voltages are used. In this application, the instruments are used in much the same manner as for power line monitoring as described above. Here again, the electronic memory of the instruments will hold indefinitely the peak amplitude of the applied voltage so that unattended, continuous monitoring of the life test is possible.

2.4.7 NEW EQUIPMENT DESIGN - The Model 5201 series find wide use in the design and development of new electronic equipments and circuitry. Such parameters as peak inverse voltage ratings of semiconductor devices are readily measured under all transient conditions. Turn-on and turn-off transients in the new equipment are quickly traced to the source and eliminated through measurements of peak transient voltage. Switching transients that may occur in electronic test instruments may be recorded and evaluated. For example, one customer's multifunction test instrument generated damaging transients when switched from one function to another. Measurements made with a Model 5201C at the test terminals recorded the transients, and enabled a quick location of the source.

2.5 GATE CIRCUIT OPERATION - Model 5201C instruments that are equipped with the gate circuit measurement feature have a switch and two additional connectors located on the rear panel. The switch designated "Gated" in the up position is used to select either the normal (down) or gated mode of operation. In the normal position, the instrument functions normally and does not require an input signal to the gate terminals. When the switch is placed in the gated position, the instrument is disabled and will not respond to a signal unless a gate signal is also present.

To use the instrument in the gated mode, first zero the instrument and set the front panel controls to the desired Range and Mode of operation. Place the gate switch in the "gated" position and momentarily depress the Reset switch. The instrument will now read down scale which is normal. The instrument will now respond to signals that are accompanied at some interval by a gate voltage that activates the signal path of the instrument only during the period that the gate signal is present. The gate signal should be synchronized with the input signal to read the desired portion of that signal. A gate signal amplitude of approximately 5 to 10 volts (of the same polarity as the signal voltage) is required. Therefore, if a positive signal is to be measured, a positive gate voltage of 5 to 10 volts must be applied to the + gate input connector. Similarly, if a negative signal is to be measured, a negative gate voltage of 5 to 10 volts must be applied to the - gate input connector.

The + gate and - gate inputs are d-c coupled and external blocking capacitors are required if the gate signals have a d-c component. The input impedances of the gate circuits

are approximately 1 K-ohms shunted by approximately 50 pF.

An alternate method of operation may be used to make gated measurements. If a gate voltage of opposite polarity to the signal being measured is applied to the gate inputs, while the gate switch is in the normal position, the instrument will be "held off" as though the gate switch were in the gated position. When this gate voltage is reduced to zero (approximately) the instrument will then measure the input signal until the gate voltage is returned to the higher value. In this mode, the gate voltage acts as an "inhibit" voltage whereas in the regular gated mode of operation, the gate voltage acts as an "enable" voltage. The required amplitude of the gate signal is approximately the same in both cases, only the position of the gate switch and the polarity of the gate voltage are reversed. (See Chart, following page).

INPUT SIGNAL	GATE SWITCH	(+) GATE INPUT	(-)GATE input	NOTES:
POSITIVE	NORM	0	0	READS MAX POSITIVE APPLIED SIGNAL
NEGATIVE	NORM	0	0	READS MAX NEGATIVE APPLIED SIGNAL
POSITIVE	GATED	+5 to 10 V	0	READS MAX POSITIVE APPLIED SIGNAL DURING GATE PERIOD
NEGATIVE	GATED	0	-5 to 10V	READS MAX NEGATIVE APPLIED SIGNAL DURING GATE PERIOD
POSITIVE	NORM	-5 to 10V	0	READS MAX POSITIVE APPLIED SIGNAL ONLY WHEN GATE VOLTAGE IS AT ZERO
NEGATIVE	NORM	0	+5 to 10V	READS MAX NEGATIVE APPLIED SIGNAL ONLY WHEN GATE VOLTAGE IS AT ZERO

2.5.1
GATE CIRCUIT OPERATION CHART

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2.5.2 5201CR OPERATION - The 5201CR is a recording memory voltmeter consisting of a standard 5201C Memory Voltmeter and a Model 5299 Recorder. The Model 5299 employs a Rustak 288 Strip Chart Recorder, with a dry process pressure sensitive chart with access window and all the necessary front panel controls to yield the recorder operative and to program the 5201C to operate with the recorder.

With the Record switch in the 'down' position, the 5201C functions as a standard instrument and completely independent of the recorder.

To operate the recorder, place the Record switch in the 'up' position, reset switch of 5201C in Automatic, and adjust recorder Gain control so that recorder deflection is equal to that of the 5201C meter. All other controls of 5201C being in their normal operating positions.

The Record switch is a double pole-double throw toggle switch, one half of which applies 115 VAC to the recorder drive motor, with the other half connecting a 5 μ F capacitor to the "External Timing Capacitor" terminal thus changing the automatic reset period to approximately 5 seconds. In this mode, any stored reading or increase in reading will be retained for approximately 5 seconds before being reset, allowing the recorder sufficient time to respond.

The recorder Gain control is a 100 ohm linear taper potentiometer used as a variable shunt for the 1 mA full scale recorder movement. When the instrument is used with the recorder off, activity of the movement may be disabled by full counterclockwise rotation of recorder Gain control.

SECTION 3.0 - THEORY OF OPERATION

(Refer to Block Diagram 5201C)

3.1 ATTENUATOR AND INPUT CIRCUITS - Voltages to be measured are applied to the instrument through a shielded cable and an ungrounded BNC Connector. The low side of the input is connected to the chassis and to ground through approximately .01 μ F and 44 megohms. Inside the instrument, the signal is applied to a six position attenuator switch that is frequency compensated for broadband response. The input signal is reduced to a level of 1.5 volts for full scale at the input to the first circuit card. When the RANGE switch (attenuator) is rotated to the higher ranges, the attenuator resistors are placed in series to increase the input resistance and to decrease the voltage developed across the individual resistors. Similarly, the frequency compensating capacitors that are across these resistors are also placed in series and thus require a sequential AC Calibration procedure starting at the lowest (3V) range.

From the attenuator, the input signal passes through the MODE switch. Here the DC Component of the signal is removed when the MODE switch is set to any of the ac positions by passing the signal through a 1 μ F capacitor. In any of the dc positions of the MODE switch, the signal is coupled directly to the input circuit card.

The Input Circuit Card contains two independent signal conditioning channels. One channel passes positive signals and the other channel passes negative signals. The two channels are complimentary and serve similar functions. In the channels, the signals pass through dc coupled systems that stretch all

outputs to a minimum duration enabling the memory circuits to store the peak value of the input signal. This duration is in the order of approximately 100 msec. Therefore, if an input signal is of lesser duration than the minimum duration, it will be stretched to increase its duration. If an input signal is greater than the minimum duration, it passes through the circuit, and its trailing edge is stretched to the minimum duration discharge curve. Thus, we have an indication of the duration of the applied input signal at the outputs of the positive and negative channels. These points are coupled to the Control Circuit Card and are also available at the output connector on the rear of the instrument for use with either an oscilloscope or strip chart recorder. The peak amplitude of the input signals is not distorted anywhere in these circuits and appears at the outputs in relative proportion to the signal input. Both the positive and negative outputs are simultaneously available, as they are two independent channels. Also contained on the input circuit cards are gain and zero adjustment controls to facilitate calibration of the instrument.

3.2 CONTROL AND REGISTER CIRCUITS - In the Control Circuit Card, the positive and negative signals are applied to independent comparator circuits. The comparator circuits compare the peak amplitude of their applied signal with a reference signal that is derived from a feedback voltage originating in the binary register or memory portion of the instrument. If the two signals are unequal, the comparator operates a gate circuit that permits pulses generated by a free running 2.5 MHz oscillator to enter the binary register circuit and increase the feedback voltage. This continues until the feedback voltage is equal in amplitude to the input signal to the comparator. At that point, the voltage comparator closes the gate. The stored reading in the

binary register is then held indefinitely even though the input signal is removed or decreased in amplitude. The stored reading is used to operate a front panel meter via a meter amplifier circuit. Also available from the meter amplifier is a 0 to +1V or +3 VDC analog signal that may be used for operating DVM's, recorders, etc. The 0 to +1 VDC output is produced on the 10, 100, and 1000V ranges and the 0 to +3 VDC output is produced on the 3, 30, and 300V ranges.

If a peak voltage greater than the stored voltage is later applied to the input, the voltage comparators will again open the gate and cause the binary register to increase in digital steps until its feedback again equals the peak value of the input signal voltage. Conversely, an input signal smaller than the stored voltage will not operate the voltage comparator circuits, and therefore will have no affect on the stored reading.

A phase splitter circuit is used to obtain both a positive and a negative feedback signal regardless of the polarity of the original signal. Thus, a positive input signal causes a positive feedback signal to appear at the positive comparator circuit, as well as a negative equivalent signal to appear at the negative comparator circuit. A negative input signal causes a negative feedback signal to appear at the negative comparator circuit, as well as a positive equivalent signal to appear at the positive comparator circuit. When both comparators are free to operate the oscillator gate circuit, the instrument will read the greater peak of positive or negative input signal voltage. This condition exists when the MODE switch is set to the $\pm$ position. If it is desired to register only positive input signals, we disable the output of the negative comparator circuit and similarly disable the output of the positive comparator circuit

when registering negative input signals only. Again, this is accomplished using the MODE switch.

3.3 RESET AND POWER SUPPLY CIRCUITS - Stored readings are cleared from the register circuit by the application of a negative reset pulse from the reset circuit. The reset pulse may be generated manually on command by pressing the RESET switch, or it may be generated periodically at specified intervals by placing the RESET switch in the automatic position. An RC time constant that can be increased by the use of external timing capacitors, determines the reset intervals in the automatic mode. In operation, the voltage across a timing capacitor increases until it reaches the triggering level of a trigger circuit. When the circuit triggers, a pulse is generated, causing a one shot circuit to generate the reset pulse that simultaneously operates a discharge circuit reducing the voltage across the timing capacitor to zero, thus initiating a new cycle. The instrument may be reset externally by causing a trigger pulse to operate the one shot circuit as above. This is readily accomplished by momentarily shorting to Common the remote reset terminal located on the rear of the instrument, either directly or through a transistor switch.

In the automatic reset mode, the reset interval may be increased up to approximately 5 seconds by the addition of external timing capacitors. This feature enables the instrument to be used with low frequency strip chart recorders, the five seconds that the reading is stored being longer than required for the slowest of recorders. However, if the reset pulse were completely independent of the input signal, a reset pulse might occur a few milliseconds after an input signal was stored, thus clearing the register before the recorder

could respond. To prevent this, a recorder Mode gate circuit is used to discharge the timing capacitor before it reaches the triggering level each time the comparators operate the oscillator gate. Thus, the timing capacitor must start from zero and time out to the five seconds every time an input signal appears or increases in amplitude.

All circuits in the instrument are powered by a Regulated Dual Power Supply. The power supplies provide + and - 10 volts through independent regulators that are powered by a common transformer winding. AC power is applied to the instrument through a two section Pi filter circuit to eliminate line transients from entering the instrument. The power supply transformer is electrostatically shielded to further prevent transients from entering the instrument.

Both the positive and negative voltage regulators are conventional in design utilizing a reference zener diode, differential voltage amplifier and series regulator transistors. Each supply is adjustable over a narrow range with voltage adjustment controls provided.

The time constants associated with the input dc voltage to the regulators are purposely made long to prevent loss of the stored voltage readings in the event of a momentary power line failure. When the instrument is operated with battery power, the regulators are still used to provide a constant output voltage as the batteries decrease in output. A wide range of battery voltages (18-24V) may be used due to the conservative ratings of the power supply components. The batteries are coupled to the instrument through coupling diodes that permit simultaneous ac and dc operation. Thus the batteries may be connected to the instrument and take over the operating of the instrument if the ac power line should fail. Note, however,

that the power supply will operate from the source that provides the higher voltage. Therefore, if the batteries that are used for this combined ac-dc operation produce more voltage than does the ac power line, the instrument will operate on battery power until they decrease to the point where the ac power supplies' output is the greater.

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SECTION 4.0 - CALIBRATION PROCEDURE

4.1 GENERAL - The Model 5201C Memory Voltmeter contains only the finest quality components operating under very conservative conditions and should require little maintenance in normal use.

If a malfunction occurs, a systematic checkout of the instrument should be performed by a competent technician. To service the voltmeter, first remove the instrument case cover by withdrawing the four retaining screws located on the case bottom and one screw at the bottom center of the front panel. Next, remove the perforated cover from the top of the chassis by removing the six retaining screws from the edges.

CAUTION: When replacing top cover and cabinet, be sure all screws are tightened down firmly. The screw on the bottom of the case marked "GND" must be firm or the case will not be grounded properly.

A multitester with input resistance of at least 10,000 ohms per volt, a digital voltmeter, a pulse generator capable of furnishing positive or negative pulses of at least 100 volts amplitude and of from 100 nanoseconds to 1 millisecond duration, a DC reference supply to 1000 V, and an oscilloscope such as the Tektronix Model 531 or equivalent are required to troubleshoot this equipment.

Should a fault be traced to one specific printed circuit board but not be located thereon, the plug-in board may be removed and returned to MICRO INSTRUMENT COMPANY for repair or replacement.

Field Calibration should not normally be required except in the event of a component failure. MICRO INSTRUMENT COMPANY

will calibrate an instrument that is still in warranty if returned prepaid to the factory, for instruments out of warranty, a slight charge will be made.

Fuse Locations

The instrument is provided with a power line fuse located on the rear of the instrument. If the instrument has a push-button power switch, a second fuse is located in the combination power switch and indicator lamp on the front panel. Both are replaceable without removing the instrument cover. If a fuse blows, it should be replaced with a slo-blo fuse of similar rating (1/2 ampere in 115 volt models, and 1/4 ampere in 220 volt models). No attempt should be made to install a higher current fuse as damage to the instrument may result. To remove the power switch fuse, turn the push-button one-quarter turn to the right and pull out; reinsert with white dot straight up.

4.2 DC CALIBRATION - Before applying power to the instrument, adjust the mechanical ZERO adjustment of the front panel meter to zero.

Connect the line cord to a source of AC power; turn on, and allow fifteen minutes for warm-up time.

4.2.1 INITIAL CONTROL SETTINGS -

Power switch - On
RANGE switch - 10 V
MODE switch - +DC
RESET switch - Auto
ZERO control - Meter set to zero.

ADDITIONAL CONTROL SETTINGS FOR 5201CR MODELS -

RECORD switch - Up
RECORDER GAIN control - As required for equal deflection of meter and recorder.

4.2.2 POWER SUPPLY ADJUSTMENTS -

(a) Connect the digital voltmeter, set to -10V Range to TP1 (violet) on the 4A card (common to Black Test Point or to chassis). This is the -10V output and should be set to $-10V \pm 0.2\%$ as read on the digital voltmeter. This voltage is adjusted using R1 located adjacent to the violet test point.

(b) Connect the digital voltmeter, set to +10V Range to TP2 (red) on the 4A card. This is the +10V output and should be set to $+10V \pm 0.2\%$ as read on the digital voltmeter. This voltage is adjusted using R2 located adjacent to the red test point.

(c) The regulation of each supply may be checked by applying ac power to the instrument through a voltage variable transformer and Checking the regulation on both supplies for less than $\pm 0.5\%$ for input variations of $\pm 10\%$ of the rated line voltage. Ripple voltage should be less than 25 mV peak-to-peak maximum.

4.2.3 METER AND SENSITIVITY ADJUSTMENTS -

(a) Set the instrument controls to the +DC MODE, Auto RESET and 10V positions.

(b) Connect the digital voltmeter to Pin 2 on J2 (common to Pin 1-J2 or chassis),

(c) Apply a positive dc voltage of approximately 30V to input of the instrument. (This insures the register card is filled to capacity).

(d) Adjust the sensitivity control R2 located on the control card (2A) for a reading of exactly +1V.

(e) Adjust the meter adjust control R1 located adjacent to the sensitivity control for exactly full scale reading on the front panel meter.

NOTE: On 5201CR instruments, the Recorder Gain control should be set to full scale during this adjustment.

4.2.4 ZERO CONTROL ADJUSTMENT - Proceeding from the previous steps,

(a) Adjust the sensitivity control R2 for a reading between +1.06 and +1.07 at Pin 2-J2. This represents 6% to 7% above full scale on the front panel meter.

(b) Next, remove the input card (1A-1) and adjust the front panel ZERO control for a reading between -.06 to -.07 volts at Pin 2 (J2). This represents 6 to 7% below zero scale on the front panel meter.

The adjustment of the front panel ZERO control affects the setting of the sensitivity control R2; therefore, the overscale and underscale adjustment may have to be repeated several times until the two are correct. The controls are properly set when a reading of +1.06 to +1.07V is obtained at Pin 2 (J2) (+30 VDC input) with the input card in place and a reading of -.06 to -.07V is obtained at Pin 2 (J2) with the input card removed. When the front panel ZERO control and the sensitivity adjustment have been properly set, DO NOT disturb the setting of the FRONT PANEL ZERO CONTROL during the remainder of the calibration except as noted.

4.2.5 INPUT CIRCUIT BALANCE & ZERO ADJUSTMENTS -

(a) Remove the input cable from instrument.

(b) Connect the digital voltmeter, set to the 100mV range, to the junction of R85 (220 Ω) and C19 (10pF) on the 5201C-1A-G card; an extender card will be useful in reaching this point. Adjust this point for a reading of zero volts using the balance control (R2) on the same card.

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(c) Reconnect the input cable and apply an input dc voltage of $+10V \pm 0.1\%$.

(d) With the digital voltmeter still connected to the junction of R85 and C19, adjust this point for a reading of 1.50 volts $\pm 0.1\%$ using the attenuator control (R1) on the same card.

NOTE: The instrument may not be reading accurately at this time.

4.2.6 AMPLIFIER ZERO AND GAIN ADJUSTMENTS -

(a) Disconnect the input cable and digital voltmeter, and set the front panel meter to zero using the + zero control (R3) located on the input circuit card (1A-1). (Note: Do not disturb the previously adjusted setting of the front panel ZERO control during this part of the calibration procedure unless the + zero control will not adjust to exactly zero. If this is experienced, the front panel ZERO control may be adjusted very slightly to obtain a true zero reading).

(b) Place the MODE switch in the -DC position and adjust the -zero control (R5) located on the input circuit card (1A-1) for a zero reading on the front panel meter. Switch the MODE control back and forth between the + and - positions to see that both positions are zeroed properly.

(c) Switch to the $\pm$ position on the MODE switch which should also be reading zero. Be sure that the RESET switch is still in the AUTO position as initially set up preceeding the calibration procedure.

(d) Reconnect the input cable; place the MODE switch in the +DC position and apply a $+10V \pm 0.1\%$ DC voltage to the input.

(e) Adjust the +Gain control (R4) for a reading of full scale on the instrument and then remove the input cable.

(f) Without disturbing the front panel ZERO control, set the instrument back to zero using the +Zero control R3. This is required due to interaction between the +Zero and +Gain controls.

(g) Reconnect the input cable and readjust the full scale reading, again using the +Gain control (R4).

The +Zero and +Gain controls are properly set when the instrument reads full scale with the applied dc voltage and reads zero with the input cable removed.

(h) Repeat the above procedure for the -Zero and -Gain controls, this time using a $-10\text{V} \pm 0.1\%$ dc test voltage and placing the MODE switch to the -DC setting. Use the -Zero control (R5) and the -Gain control (R6) both located on the input circuit card (1A-1) as above, to obtain similar results in the -DC Mode.

This completes the DC Calibration of the instrument. At this time, various functions and general operation of the instrument may be checked.

4.2.7 LINEARITY TEST - Check the meter reading at various points on the scale typically all cardinal points versus input voltage accurately measured using the digital voltmeter. The instrument should read the applied voltage $\pm 3\%$ of full scale (1½ small divisions).

The linearity should be checked on both the -DC and +DC Modes.

4.2.8 RANGE SWITCH TEST - Check the full scale readings on both polarity modes at 3, 10, 30, 100, 300, and 1000 volts versus an accurately measured input dc test voltage. The instrument should read the applied full scale voltage $\pm\frac{1}{2}\%$.

4.2.9 DC ANALOG OUTPUT TEST - Check the DC analog output voltage on Pin 2-J2 for +1V $\pm 2\%$ at full scale on the 10, 100, and 1000V ranges. Next, check for +3V $\pm 2\%$ at full scale on the 3, 30 and 300V ranges.

4.3 AC CALIBRATION, GENERAL - The AC calibration of the Model 5201C instrument is essentially one of frequency compensation of the input attenuator (Range switch). As in any attenuator, the RC product of each element must be equal or the attenuator will produce "overshoot" or "undershoot" at some applied frequency. At low frequencies (or slow rise time pulses) the small values of the capacitors in the attenuator have a high impedance and do not affect the circuit. However, at high frequencies (or fast rise times) the capacitors present a much lower impedance than the resistors and their adjustment is critical.

The only AC Calibration Controls are the six trimmer capacitors (C1 through C6) with labeling corresponding to each range that they effect. Note that these trimmers are in series as the range switch is turned to the upper ranges. This requires that the trimmers be adjusted sequentially starting from the 3V range and working upward. An individual trimmer can not be adjusted later without affecting all upper ranges.

The AC Calibration method described in this manual utilizes a General Radio Model 1217-B pulse generator. This model was selected because it has a flat-topped output with no overshoot on all ranges. Therefore, the generator may be switched from

one range to another and still have the exact same output voltage peak. This is not true of many pulse generators that may have other features not required for the AC Calibration.

All Model 5201C instruments are calibrated using this generator up to and including the 30 volt range. Above this Micro Instrument Company uses a booster circuit to calibrate the instruments up to 500V which is mid scale on the 1000V Range.

4.3.1 AC CALIBRATION PROCEDURE - Set the instrument controls to the +AC MODE and 3V RANGE and return the RESET switch to the normal (center) position.

Apply a 3V positive pulse approximately 500 usec wide, having a repetition rate of not greater than 10 pulses per second and a rise time of at least 25 nanoseconds. The amplitude of this pulse may be measured with an accurately calibrated wide band oscilloscope. However, this is not required if a pulse generator is used that has a flat top output over the range of 500 usec to .5 usec.

NOTE: During the AC Calibration, the duty cycle of the input a-c waveform must be less than 1% in order to eliminate averaging errors that would be caused by the input coupling capacitor if higher duty cycles were used. In addition, the RESET switch must be manually depressed frequently to obtain true readings due to changing input signal amplitudes, turning of trimmer capacitors and transients originating in the auxiliary calibrating instruments. Always press and release the RESET switch prior to making a reading. The automatic reset mode may not be used during the AC Calibration due to the low duty cycle of the input waveform.

Adjust the output of the pulse generator to obtain a reading near full scale. Rotate the trimmer capacitor (C1) until a minimum reading is obtained on the front panel meter while operating the reset switch manually frequently. Next set the generator output to obtain a convenient reading point at or near full scale and note this reading. Next reduce the pulse generator to obtain a pulse width of approximately .5 usec, being sure that the pulse amplitude remains the same. At this point the meter will be reading less than the value noted with the 500 usecond pulse. Rotate the trimmer capacitor (C1) clockwise until the reading with the .5 usec pulse is the same as the reading noted with the 500 usec pulse. Again, it is important that the reset switch be manually operated frequently while adjusting this trimmer.

The 3V range is properly calibrated when the reading at 500 useconds is the same as the reading at .5 usec provided that the 500 usec reading was obtained and noted with the trimmer capacitor (C1) set for minimum capacitance (minimum reading).

To continue the AC Calibration procedure, set the range switch to the 10V position and repeat the above procedure using a higher amplitude pulse of approximately 10 volts, and using the 10V trimmer (C2). This same procedure is then continued on all ranges sequentially. If a pulse generator is not available for the higher ranges, the instrument may be calibrated at a point on the lower end of the scale with only slight loss of accuracy. To calibrate the higher ranges with a pulse of less than full scale amplitude, follow the above procedure except that the point selected to apply the 500 usec pulse and note the reading will not be near full scale, but only as high up on the scale as the pulse generator available will permit. It is recommended that a pulse of at least 100V be used when calibrating the 1000V range.

The above AC Calibration procedure is referenced to the DC Calibration of the instrument which can be established using very precision standards. The theory of AC Calibration is that a pulse of 500 usec is equivalent to D.C. to the instrument in that 250 usec is the absolute maximum time that the memory portion of the instrument requires to fully store any input signal. After the 250 usec period, no further action takes place internally that would affect the reading.

The trimmer capacitors of the attenuator are initially set to their minimum positions to assure that there is no overshoot of the input pulse that might cause a higher reading than normal. When the pulse is reduced to the .5 usec pulse width, the trimmers are brought back up to the properly frequency compensated position.

Using this method, the AC Calibration of the instrument can be referenced to its DC Calibration with considerably more accuracy than could be obtained by attempting to measure the exact amplitude of the AC Calibration pulses.

4.3.2 PULSE STRETCHER ADJUSTMENT - The Pulse Stretcher controls are factory set for a pulse stretch time of approximately 100 msec at full scale and will not normally require readjustment. If a transistor in the circuit is replaced or if the control has been accidentally misadjusted, the controls may be properly adjusted as follows:

Apply a positive pulse of not greater than 1 ms in duration with a repetition rate of less than 10 Pulse Per Sec to the instrument set to the +10 VAC position. Connect an oscilloscope to Test Point #1 on the 5201C-1AG Card. The waveform here is a pulse of approximately 2.5 volts peak amplitude decaying linearly toward zero. Adjust the base line of this pulse to a width of 100 ms $\pm$ 20 ms using R7, the + Pulse Shield Adj. control.

Repeat the above procedure using a negative 10 volt pulse with the instrument set to the -10 VAC position. The negative pulse is adjusted to 100 ms $\pm$ 20 ms using R8, the - pulse stretch adj. control, and measured at TP2 on the 5201C-1AG Card.

SECTION 5.0 - SUPPLEMENTAL INFORMATION

5.1 RECOMMENDED SPARE PARTS LIST - The value and type of each component used in this instrument is provided on the schematic drawings contained in this manual. All components used in the Model 5201C Memory Voltmeter are readily available from local electronic distributors or from MICRO INSTRUMENT COMPANY directly.

A list of recommended spare parts follows:

	<u>Qtv.</u>	<u>Type</u>	<u>Mfg. or Supplier</u>
<u>Semiconductors</u>	1	2N2142	Motorola
	1	2N3567	Texas Instruments
	1	2N4913	Motorola
	4	2N3564	Fairchild
	4	2N3565	Fairchild
	1	2N3638	Fairchild
	4	2N3640	Fairchild
	4	2N3646	Fairchild
	4	2N4249	Fairchild
	1	1N718A	Dickson
	2	1N754A	Dickson
	2	M71	Solitron
	4	1N914	Fairchild
<u>Trim Pots</u>			
	2	3009P-1-501	Bourns
	2	3009P-1-102	Bourns
	2	3009P-1-502	Bourns
	2	3009P-1-203	Bourns

	<u>Qty.</u>	<u>Type</u>	<u>Mfg. or Supplier</u>
<u>Chokes</u>	2	4662	Miller
<u>Fuses</u>	2	½Amp Slo-Blo	Buss

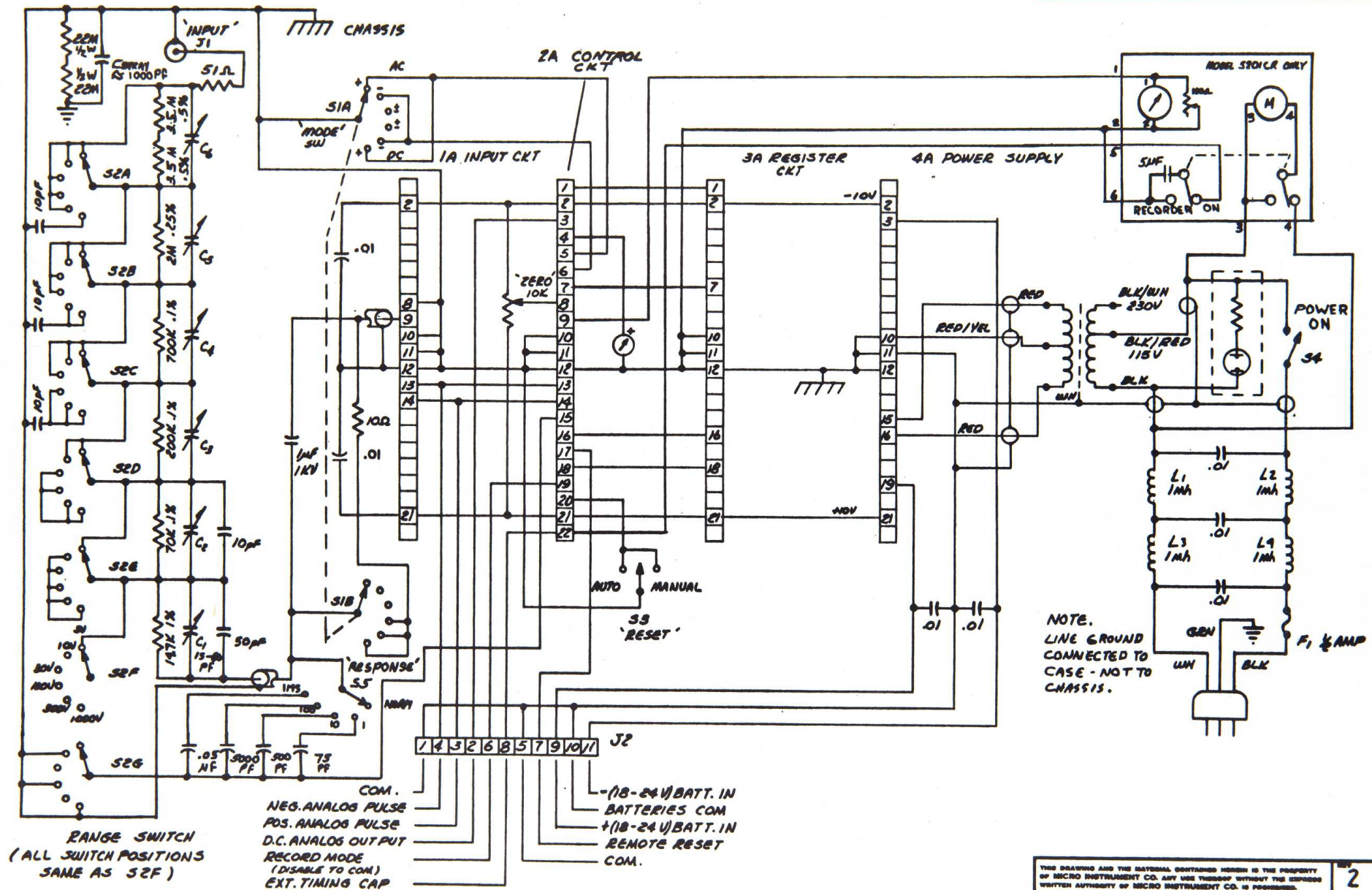
5.2 CHANGES AND MODIFICATIONS -

5.3 DRAWING LIST, MODEL 5201C MEMORY VOLTMETER

<u>TITLE</u>	<u>DWG. NO.</u>
INTERWIRING DIAGRAM	5201C-000
BLOCK DIAGRAM	5201C-001
CONTROL & TEST POINT CHART	5201C-002
OUTPUT CONNECTION CHART	5201C-003
INPUT CIRCUIT CARD (UNGATED)	5201C-1A
INPUT CIRCUIT CARD (GATED)	5201C-1AG
CONTROL CIRCUIT CARD	5201C-2A
REGISTER CIRCUIT CARD	5201C-3A
POWER SUPPLY CARD	5201C-4A

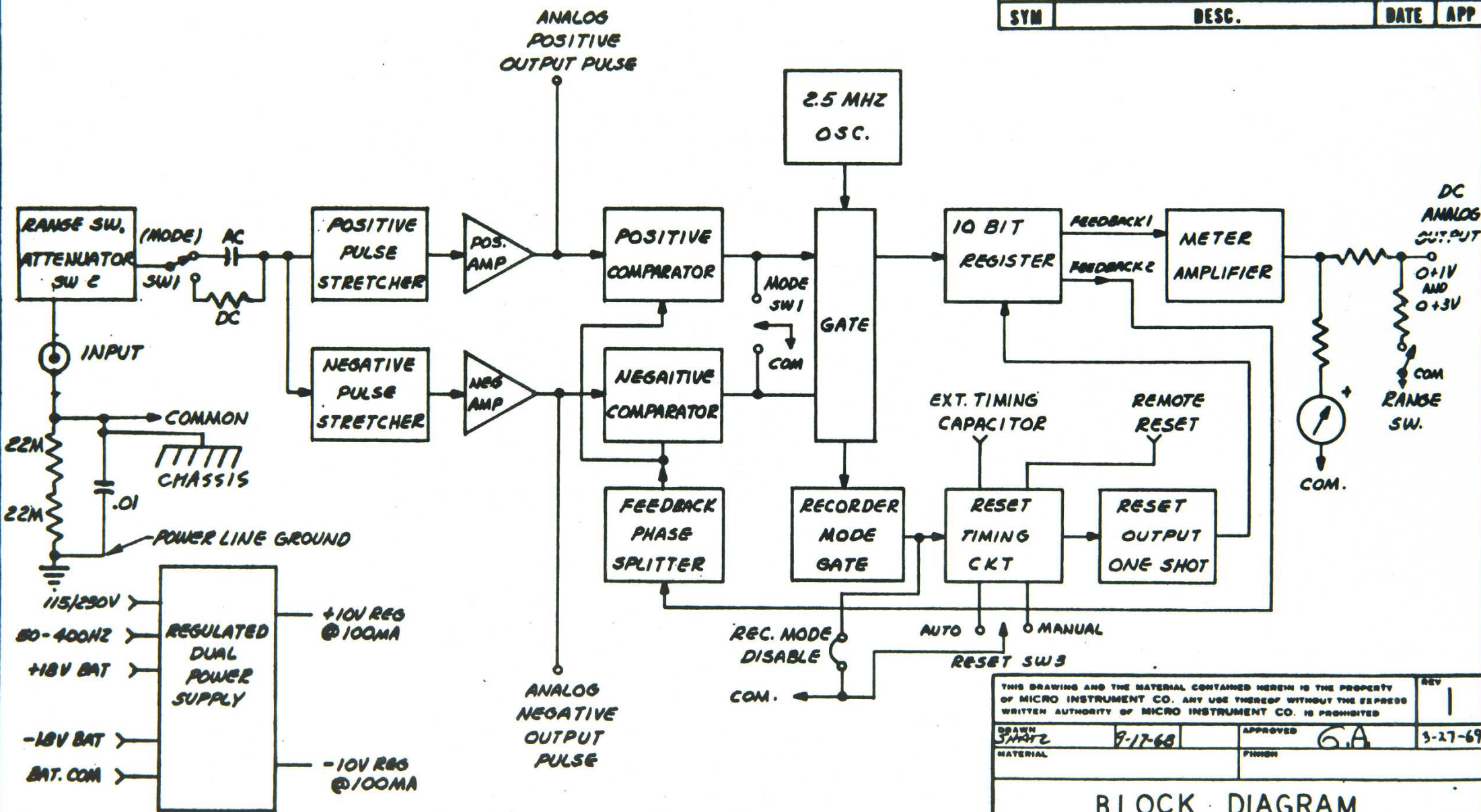
The following additional drawings are applicable to Model
5201C, Serial No. _____.

REVISIONS			
SYM	DESC.	DATE	APP

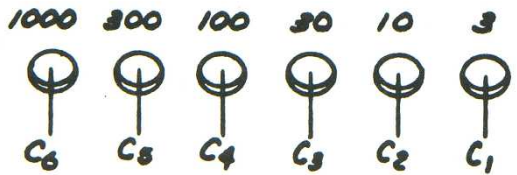
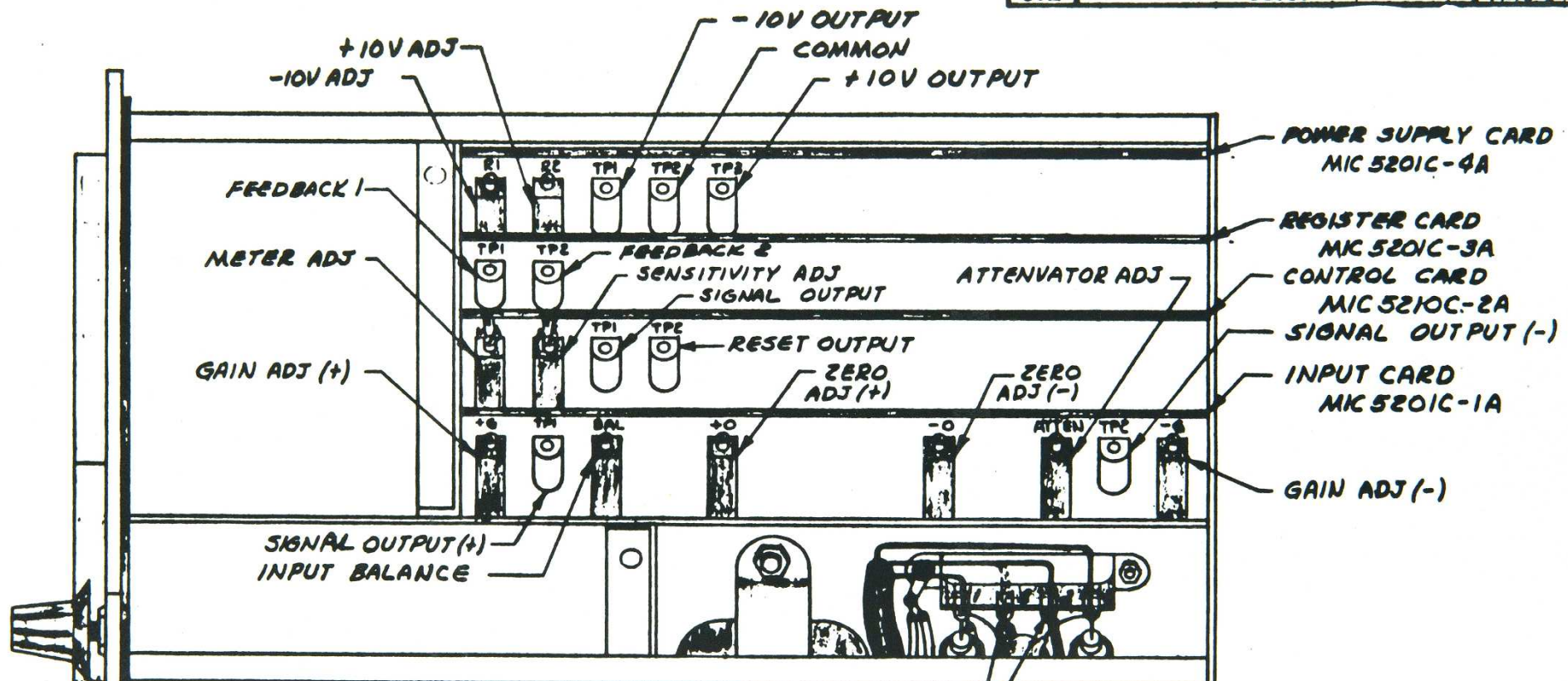


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DESIGN	DATE	APPROVED
BY	1-22-68	G.A.
CHECKED		
INTERWIRING DIAGRAM		
MICRO INSTRUMENT CO. LOS ANGELES, CALIF.		520IC-000
		SH OF

REVISIONS			
SYM	DESC.	DATE	APP



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DRAWN SARF	8-17-68	APPROVED G.A.	REV 1
MATERIAL		FINISH	3-27-69
BLOCK DIAGRAM			
MICRO INSTRUMENT CO. LOS ANGELES, CALIF.			DWG. NO. 520IC-001



NOTE: MOVE THE RED
24 GA WIRE TO TERM.
#2 FOR 230VAC
OPER. @ 50 -
400 HZ

REVISIONS			
SYM	DESC.	DATE	APP

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DRAWN JHWZ	3-18-68	APPROVED G.A.	3-27-69
MATERIAL		FURNISH	

CONTROL AND TEST POINT CHART

INSTRUMENT CO.
LOS ANGELES, CALIF.

5201C-002

REVISIONS

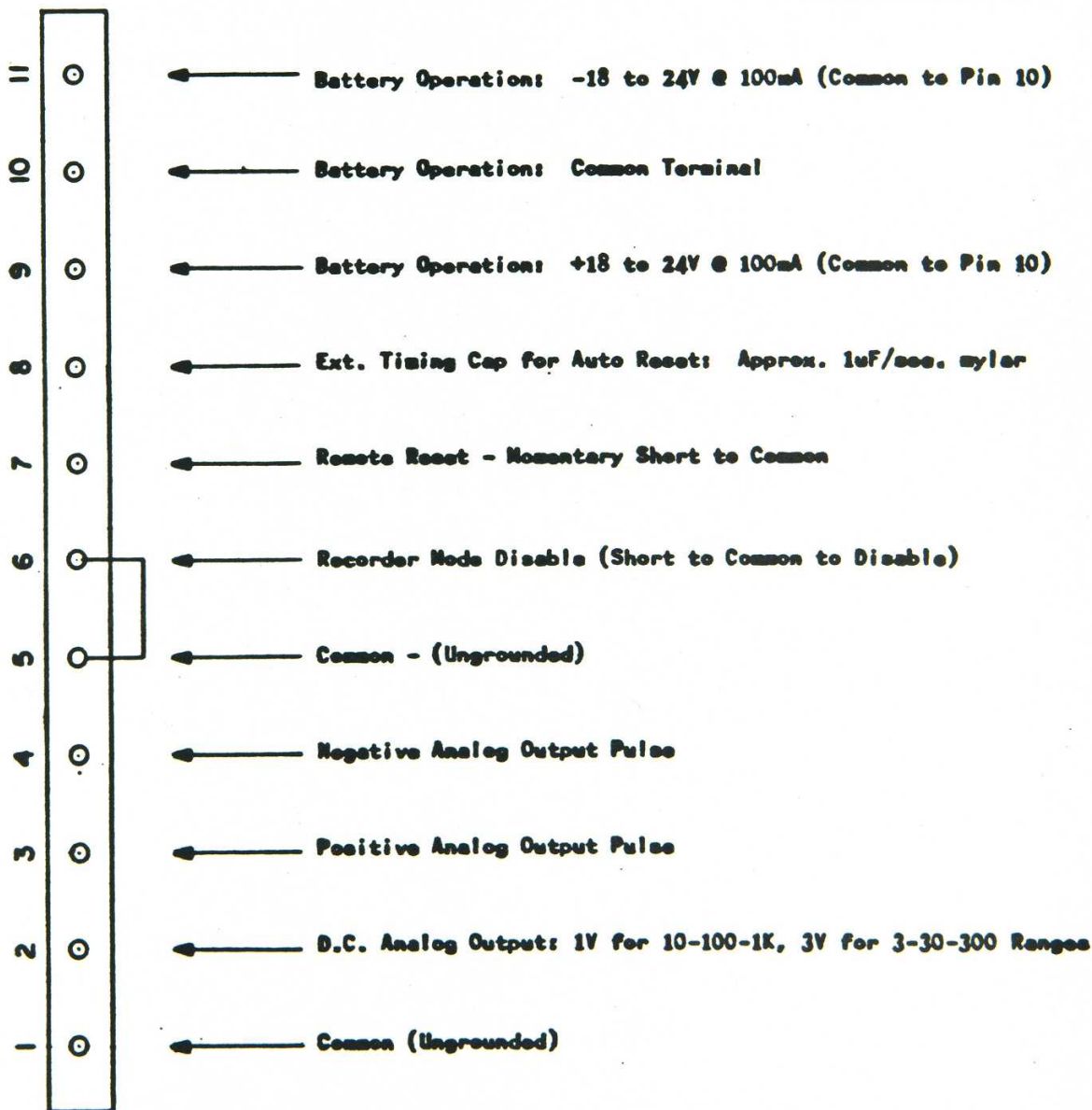
DESC.

SYM

DATE

APP

OUTPUT CONNECTOR J2



NOTE: Common leads are isolated from Ground via 44 meg

CAUTION: Do not accidentally ground the common line via external equipment as input common lead will also be grounded.

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DRAWN: J. J. J.

7-17-68

APPROVED: G. A.

3-27-69

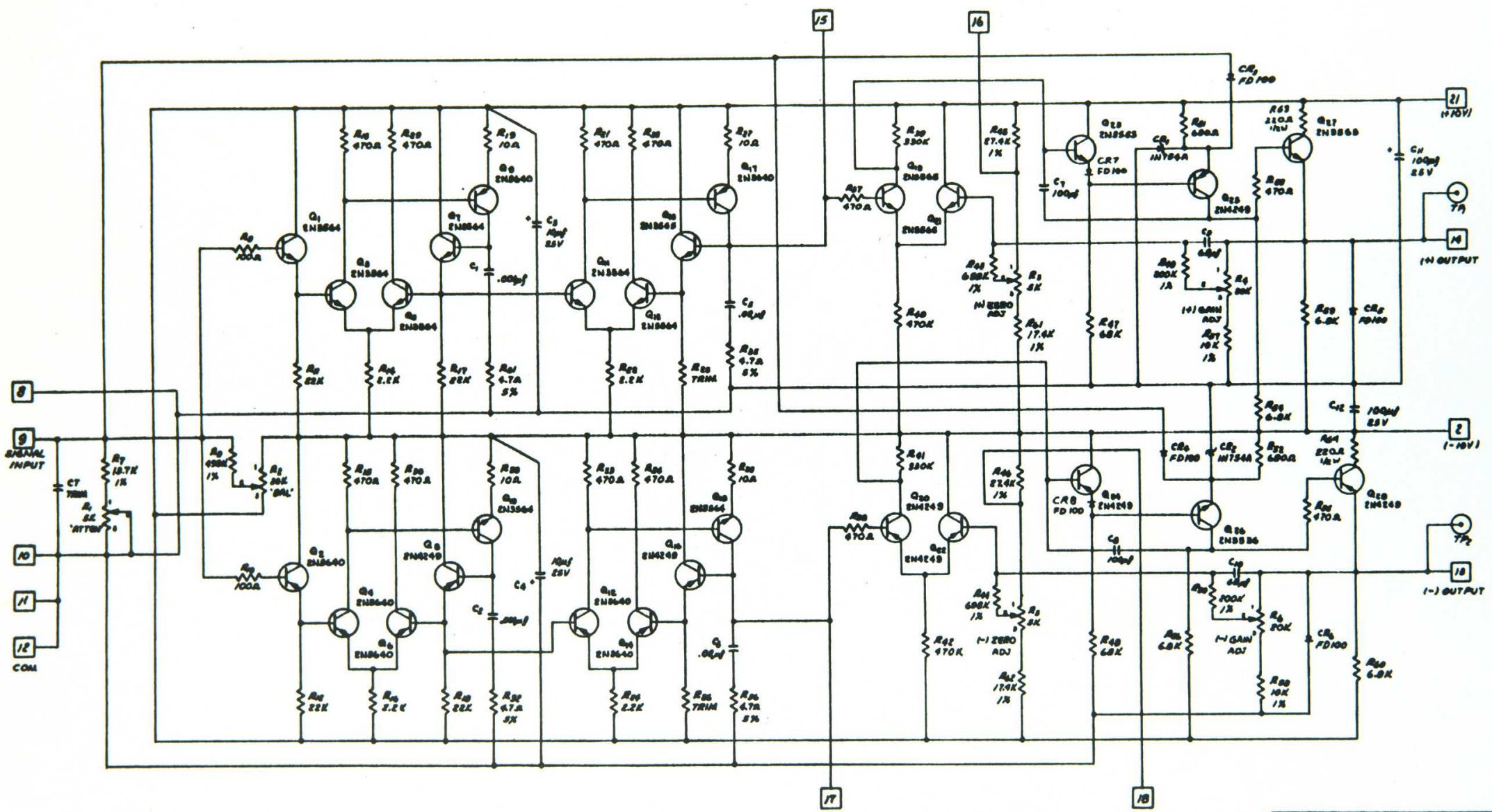
MATERIAL

OUTPUT CONNECTOR CHART

DATE: 12-1-68

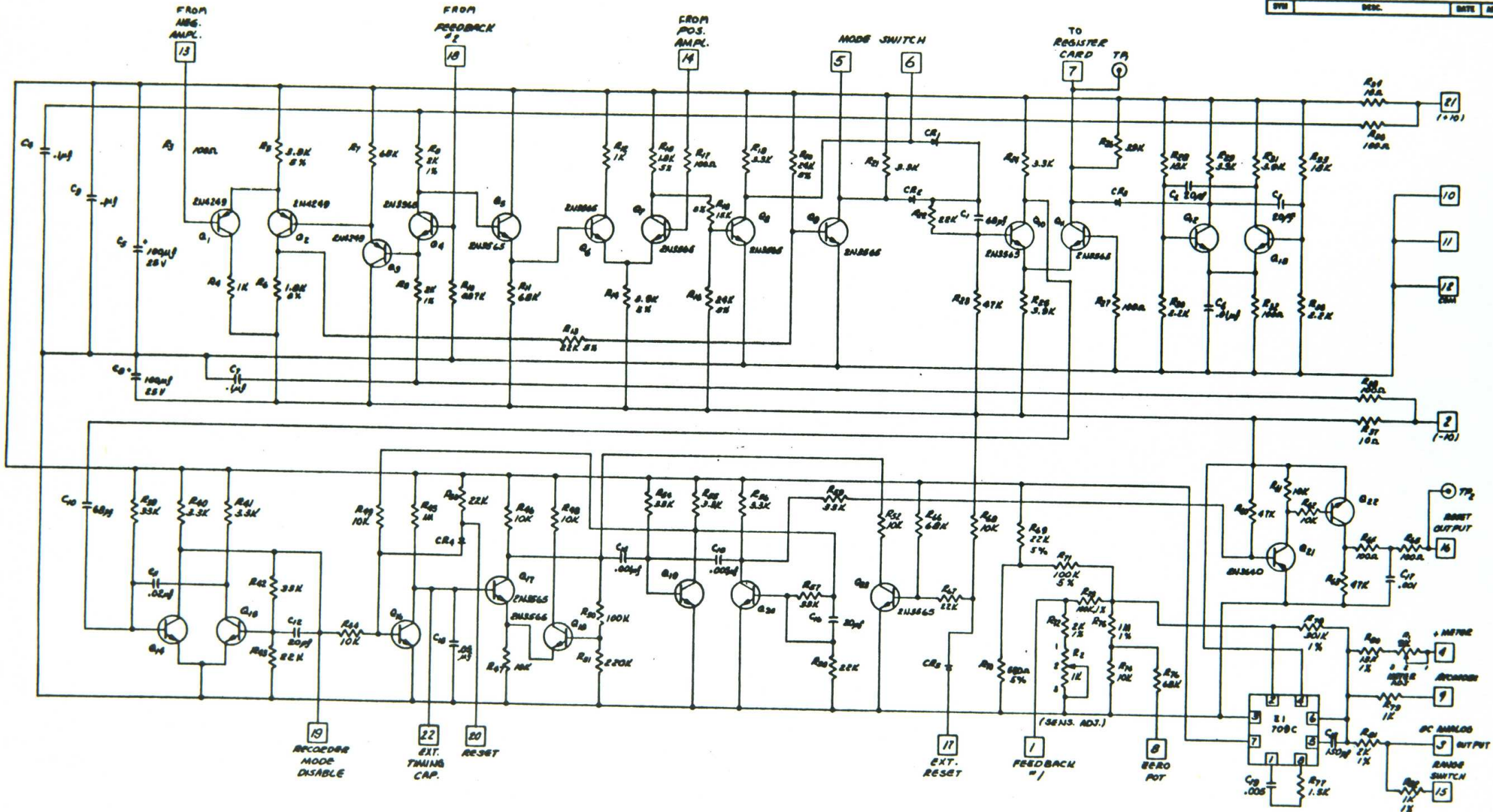
MICROC INSTRUMENT CO.
LOS ANGELES, CALIF.

5201C-003



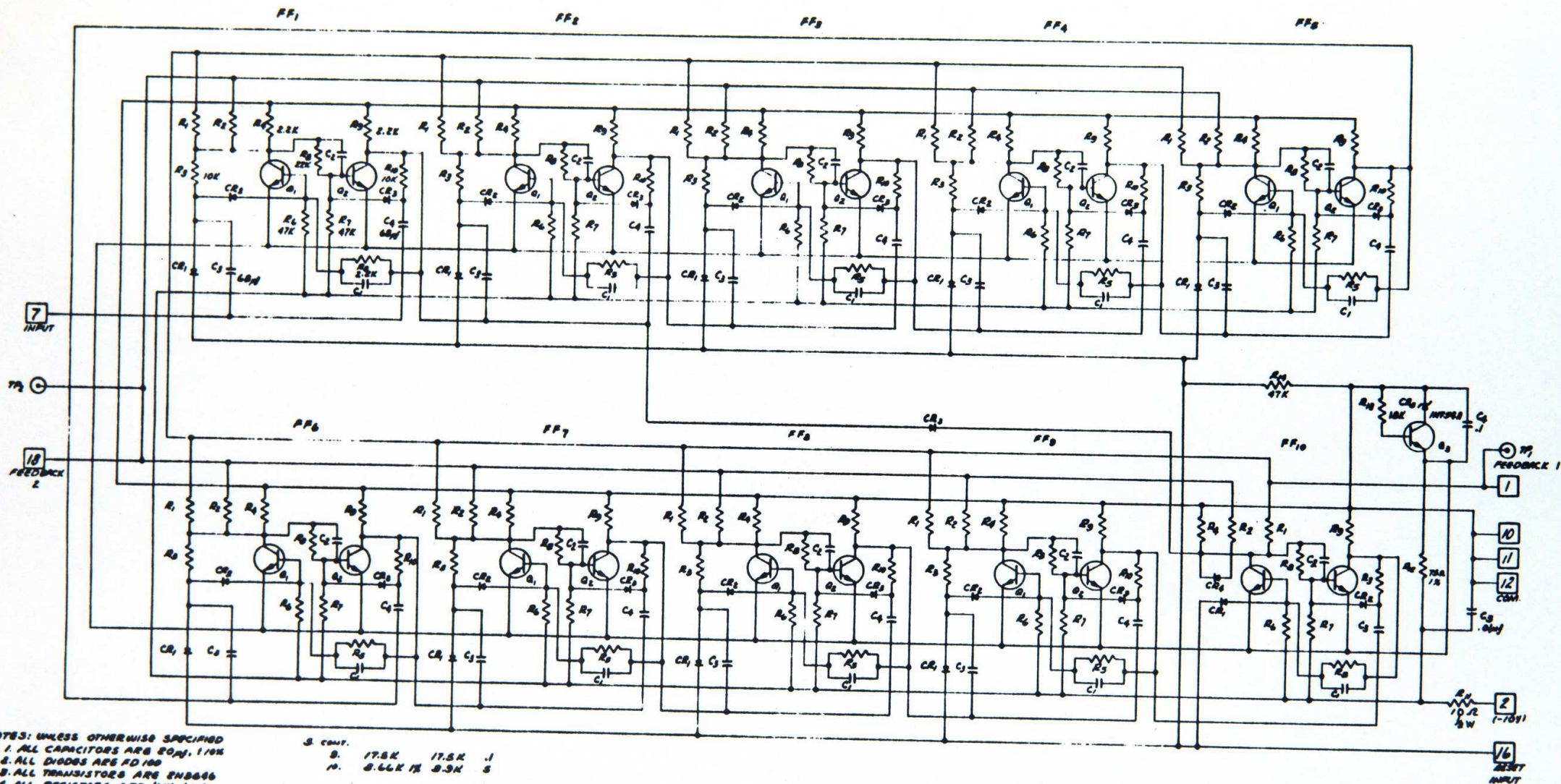
1. ALL RESISTORS ARE 1/4 W ±10%
 NOTES: UNLESS OTHERWISE SPECIFIED

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520IC-1A		DATE	APP.
INPUT CIRCUIT CARD		520IC-1A	
SISCO INSTRUMENT CO. LOS ANGELES, CALIF.		SH	



3. ALL DIODES ARE PD100
 2. ALL RESISTORS ARE 1/4 W 5% (ALL 1% RESISTORS ARE 1/4 W)
 1. ALL TRANSISTORS ARE 2N3646
 NOTES: UNLESS OTHERWISE NOTED

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DRAWN BY J. A. 1-7-60	CHECKED BY G. A. 1-11-60
CONTROL CIRCUIT CARD	
INSTRUMENT CO. LOS ANGELES, CALIF.	
520IC-2A	

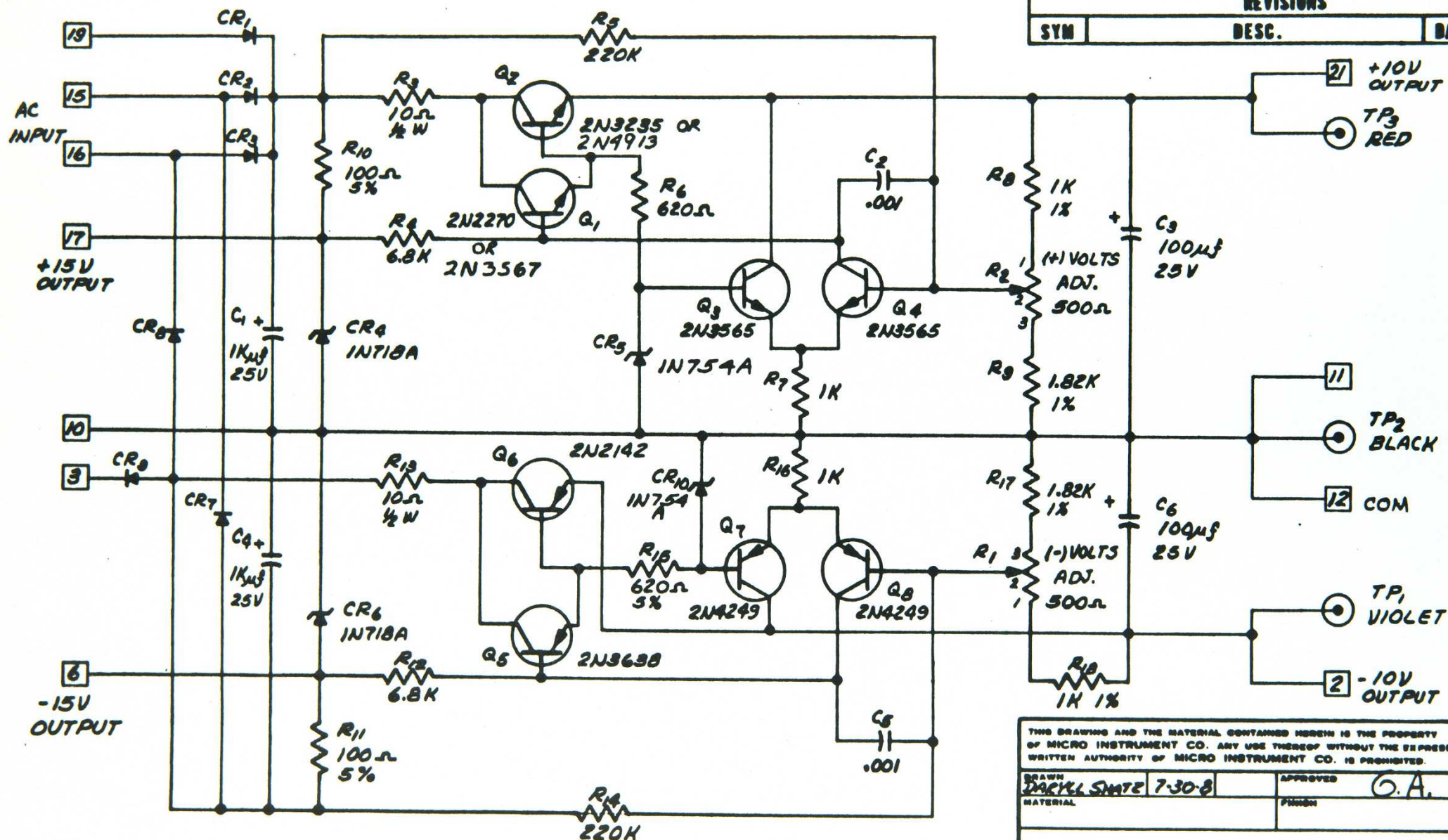


NOTES: UNLESS OTHERWISE SPECIFIED
 1. ALL CAPACITORS ARE 50V, 10%
 2. ALL DIODES ARE PD100
 3. ALL TRANSISTORS ARE 2N3636
 4. ALL RESISTORS ARE 1/2W, 1%
 5. FOR RESISTOR VALUES NOT SHOWN
 REFER TO FF #1. R1 AND R2 SEE BELOW.

S. CONT.
 9. 17.5K 17.5K .1
 10. 8.66K 1% 8.5K .5

FF NO	R1	R2	%
1	4.3M	4.3M	.5
2	2.2M	2.2M	.5
3	1.1M	1.1M	.5
4	560K	560K	.5
5	280K	280K	.5
6	140K	140K	.5
7	70K	70K	.1
8	35K	35K	.1

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DATE: 5-7-69	DESIGNED BY: G.A.	15-27-69
REGISTER CIRCUIT CARD		
MICRON INSTRUMENT CO. LOS ANGELES, CALIF.		MIC 520IC-3A



REVISIONS			
SYM	DESC.	DATE	APP

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DRAWN JACKEL SMITH	7-30-68	APPROVED G.A.	3-27-69
MATERIAL		FINISH	

POWER SUPPLY CARD

MICRO INSTRUMENT CO.
LOS ANGELES, CALIF.

SUB. NO.
5201C-4A

2. DIODES ARE M6B
1. ALL RESISTORS ARE 1/4 W, 10%
NOTES: UNLESS OTHERWISE SPECIFIED

ADDENDUM

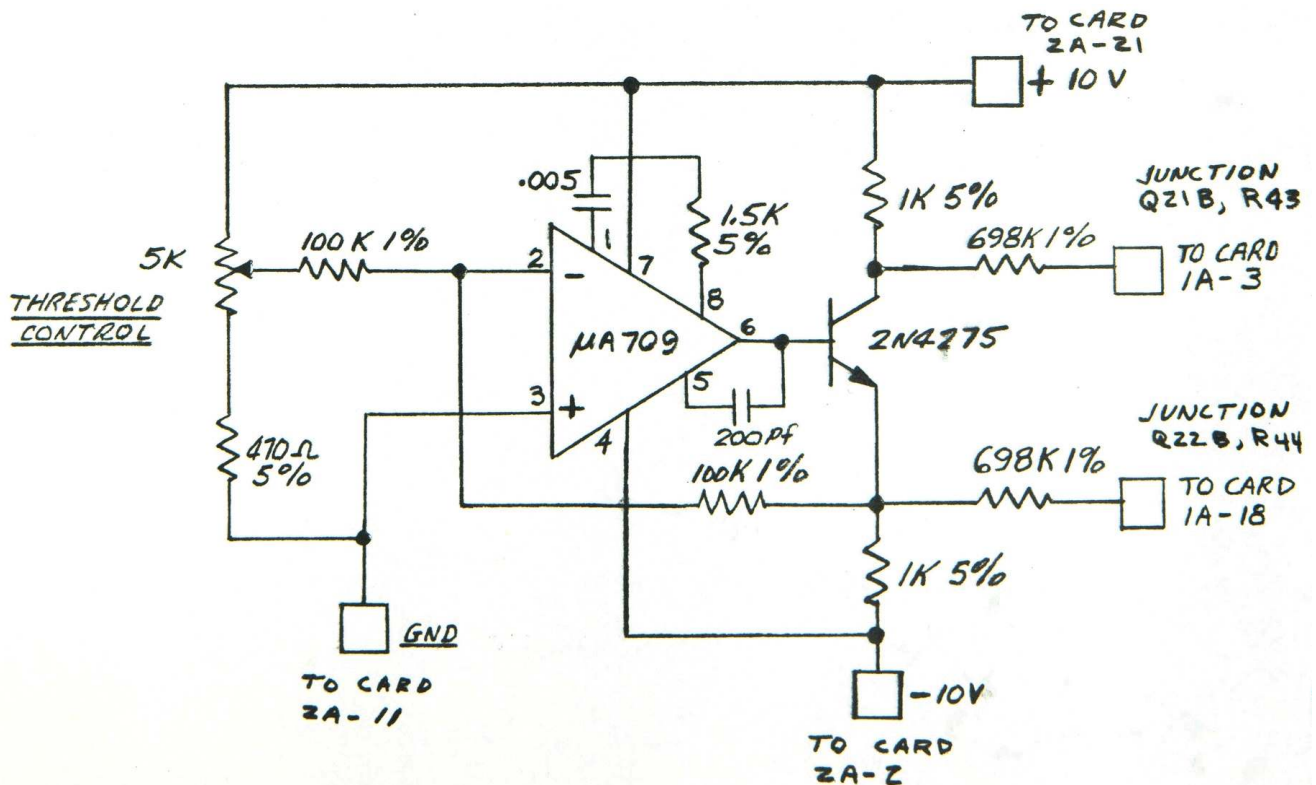
THE THRESHOLD CIRCUIT employs a front panel control and an I.C. operational amplifier so arranged to provide a programmable, down scale zero offset.

The range of the threshold control is continuously variable from zero to 100% of full scale of the 5201C. The 5201C with threshold will display the magnitude by which the input signal exceeds the programmed threshold voltage.

Accurately programming the threshold is achieved by starting with the threshold control full counterclockwise and the 5201C calibrated and zeroed. Set Reset Mode to Automatic and connect a variable DC voltage source to the input terminal of the instrument. Select proper mode and range for measurement of the desired threshold voltage. Adjust DC voltage source until 5201C reads the desired threshold value. Rotate threshold control until panel meter of 5201C reads zero volts.

Once threshold is properly set, it may be said of any reading taken that: $V_{in} = V_{meter} + V_{threshold}$.

Below is the schematic of the threshold circuit and its connections to the basic 5201C.



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☐ voltage ☐ current

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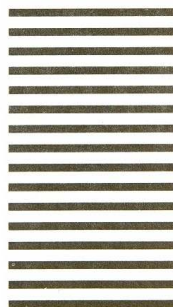
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Note: OCR'd document. Some characters may be misinterpreted. Amsterdam, 2026-03-03.